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SAUL EPSTEIN  
Attorney at Law  
Patent Lawyer

14558 Deervale Place  
Sherman Oaks, CA 91403

Telephone: (818) 789 5346  
Facsimile: (818) 990 3603

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COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231

Sir:

Transmitted herewith for filing is the patent application of Saul Epstein et al. for "Acoustic Musical Instrument of the Violin Family with Piezo-Electric Pickup".

Enclosed are:

1. The specification,
2. Two sheets of informal drawings (Two sets),
3. A Declaration and Power of Attorney executed by the inventor.
4. A verified statement to establish small entity status.
5. An Information Disclosure Citation form.
6. A check for \$385.00 to cover the filing fee, calculated as follows:

	Claims Filed	Number Extra	Large Business Rate	Business Amount	Small Entity Rate	Entity Amount
Basic Fee				\$770		\$385
Total Claims	5 - 20 =	0	@ \$ 22 =		@ \$ 11=	0
Independent	1 - 3 =	0	@ \$ 80 =		@ \$ 40=	0
Multiple Dependent Claims		0	@ \$260 =		@ \$130=	0
TOTAL FILING FEE.....						\$385

Respectfully submitted

*Saul Epstein*  
SAUL EPSTEIN,  
Reg. No.25449

14558 Deervale Place,  
Sherman Oaks, CA 91403  
(818) 789 5346

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ACOUSTIC MUSICAL INSTRUMENT OF THE VIOLIN FAMILY  
WITH PIEZO-ELECTRIC PICKUP

BACKGROUND OF THE INVENTION

Acoustic musical instruments of the violin family, i.e., the  
5 violin, viola, cello, and double bass, generate a relatively small  
amount of acoustic power, and electronic amplification is often  
desirable. This invention is intended to facilitate such  
amplification.

Among the objects of the present invention are to provide an  
10 electric pickup for an acoustic instrument of the violin family  
that:

1. produces the full range of sound, both bowed and plucked;
2. has a high output level before amplification;
3. is relatively immune to acoustic feedback
- 15 4. is convenient to install;
5. does not require modification of the original instrument;
6. does not impair the acoustic properties of the original  
instrument; and
7. is economical to produce.

20 Other objects and advantages of the invention will become  
apparent to those skilled in the art from a reading of the  
following specification.

## SUMMARY OF THE INVENTION

This invention involves a stringed musical instrument wherein one or more piezo-electric crystal sensing elements are placed under one of the feet of the bridge. In particular the invention is applicable to acoustic instruments of the violin family, e.g., violin, viola, cello, and double bass, which instruments include (within the body) a sound post located under one foot of the bridge and a relatively stiff bass bar under the other foot. The sound post couples the string induced vibrations of the bridge to the back of the instrument, while the bass bar runs longitudinally through the instrument and stabilizes the top under the bass string side of the bridge. Even though the bass bar is relatively stiff, vibrations are nevertheless induced in the top by forces coupled from the strings to the top through the bass string side foot.

The sensing element(s) of the present invention are placed between the bridge and the instrument top, preferably under the foot of the bridge which is supported by the bass bar. The pickup forms a part of the coupling of vibrations from the strings to the top of the instrument; hence the forces which cause the top to vibrate are transmitted through and are developed across the pickup. This leads to a very clear and natural sound. It has been found that a bass side location of the pickup results in an electronically amplified sound which more closely replicates the acoustic sound of the instrument than does a location under the treble side of the bridge.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of the body of a musical instrument which includes the present invention.

Figure 2 is a fragmentary cross sectional view of the musical  
5 instrument of Figure 1, taken at 2-2 of Figure 1.

Figure 3 is a plan view of one embodiment of a pickup according to the present invention; said embodiment including two sensing elements.

Figure 4 is a cross sectional view of the pickup of Figure 3  
10 taken at 4-4 of Figures 1 and 3. The pickup is shown exploded in the vertical direction for clarity. Portions of the instrument top and the bridge are also shown.

## DETAILED DESCRIPTION OF THE INVENTION

A portion of a musical instrument of the violin family is shown in Figure 1, which instrument incorporates the present invention and includes a top 11, a bass bar 12, a sound post 13, a bridge 14, and strings 15 having different resonant frequencies. The strings having the lowest resonant frequencies are called the bass strings. A piezo-electric pickup 16 is located between the foot 17 of bridge 14 and top 11. The pickup 16 is preferably located under the foot of the bridge which is supported by the bass bar, i.e., under the side of the bridge nearest the bass strings. Tension in the strings forces the bridge against the instrument top, resulting in good contact between the pickup and the bridge. Hence, vibrations of the strings are coupled directly to the pickup, and high output is obtained. Since the bass bar is relatively stiff, it, as well as the top, form a base against which the force which drives the pickup is developed.

The pickup 16 may include one or more sensing elements 18; the pickup shown in Figure 3 including two. Generally, the smaller instruments, such as the violin and viola will use one sensor, while the larger cello and double bass may use two.

As can be seen in Figure 4, the pickup is a sandwich of several elements. The bottom layer, which rests against the instrument top, is a piece of conductive foil 19 which acts as an electrical shield. It is connected to the shield/ground of the shielded output lead 20. An insulating pad 21 insulates foil 19

from the "hot" foil connector 22, which foil rests against one side of the sensor(s) 18. Foil connector 22 makes the "hot" connection to the sensor(s). Foil 22 is connected to the center conductor of of output lead 20, which conducts the output signal to an amplifier (not shown). The area of the pickup surrounding the sensor(s) 18 is filled with a soft insulating material, such as double sided foam tape 23. The tape 23 holds the pickup together before it is installed on an instrument, but being soft, does not appreciably affect the pressure of the bridge foot on the sensor(s). The sensor ground connection is made by foil sheet 24, which is located between the bridge foot 17 and sensor(s) 18. Foil sheet 24 is connected to the ground/shield of output lead wire 20. Conductive foil sheets 19 and 24 effectively shield the pickup from extraneous electric fields.

With the construction shown, the pressure of the bridge is concentrated on the sensing element(s) located under the bridge foot. Preferably, the pickup is situated between the bridge foot which is over the instrument's bass bar (which is a relatively stiff member) and the top of the instrument. This results in a strong signal, with a high signal to noise ratio, and a minimum of extraneous sound, such as bow noise. The bass bar location also contributes to a reduced difficulty from acoustic feedback. While the bass bar is relatively stiff, it does not prevent the top from being vibrated by the forces transmitted through sensor(s) 18 from the bass string side bridge foot.

Since piezo-electric sensing elements can be made quite small  
(3/16 in. diameter X 1/32 in thick being readily available) a  
pickup as described above can easily be installed on an existing  
violin, or other instrument of the violin family, without  
5 modification of the instrument. Also since the sensing element(s)  
can be small as indicated in the previous sentence, a pickup can  
be made according to the construction described which is flexible  
and can be made to conform to the curved shape of the top of the  
instrument. It has been found that installation of such a pickup  
10 does not impair the acoustic properties of the instrument.

I claim:

1. In an acoustic musical instrument of the violin family, which includes a body having a top, a plurality of strings having different resonant frequencies, a bridge supporting said strings, said bridge having feet which are  
5 pressed against said top by tension in said strings and causing said top to vibrate in accordance with vibrations of said strings, and a bass bar supporting said top under the foot of said bridge closest to the bass strings, the improvement which comprises:

10 a pickup comprising one or more piezo-electric sensing element(s), said pickup being located between a foot of said bridge and said vibrating top.

2. In an acoustic musical instrument of the violin family as recited in claim 1 wherein said pickup is located between the foot of said bridge closest to said bass strings and said vibrating top.

3. In an acoustic musical instrument of the violin family as recited in claim 2 wherein substantially all of the force exerted by said base side foot is transmitted to said vibrating top through said piezo-electric sensing element(s).

4. In an acoustic musical instrument of the violin family as recited in claim 1 wherein said piezo-electric sensing element(s) are encased in a foil sandwich which provides shielding from external electric fields.

5. In an acoustic musical instrument of the violin family as recited in claim 4 wherein said pickup is flexible and is conformable to the shape of said top.

## ABSTRACT

A musical instrument of the violin family which has a piezo-electric pickup installed under the foot of the bridge which is supported by the bass bar. The forces generated in the bridge by  
5 the vibrating strings are transmitted through the pickup to the top of the instrument. The pickup is comprised of a sandwich including a small piezo-electric sensor covered by conductive foils on the outside which serve as the ground of the pickup and an electrostatic shield.

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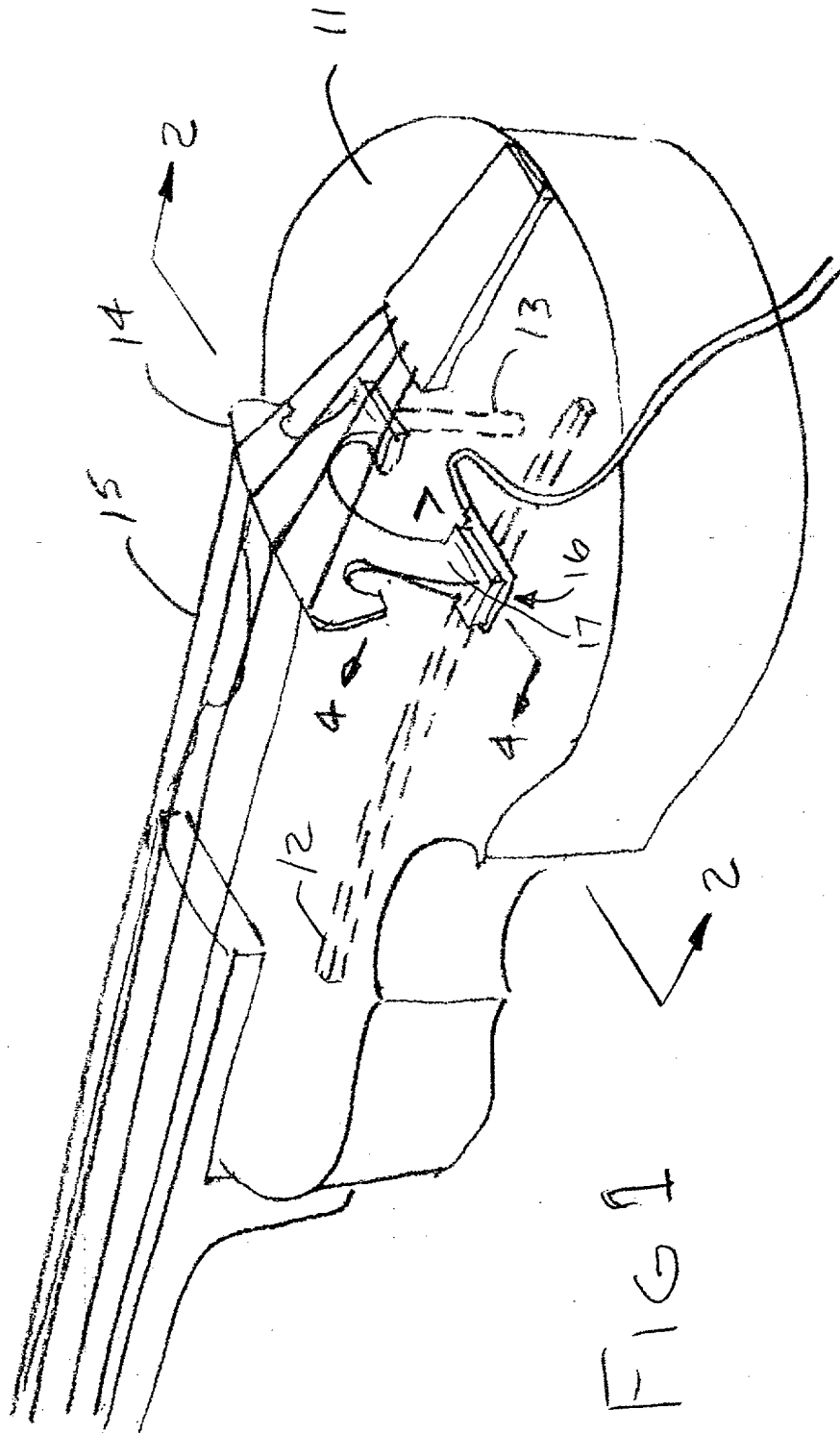


FIG 2

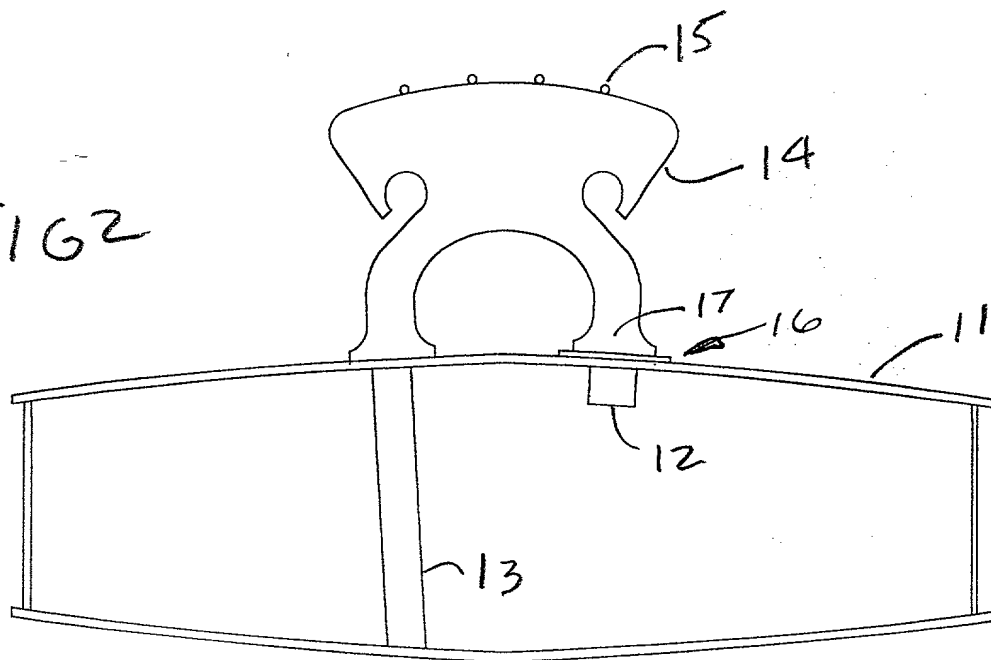


FIG 3

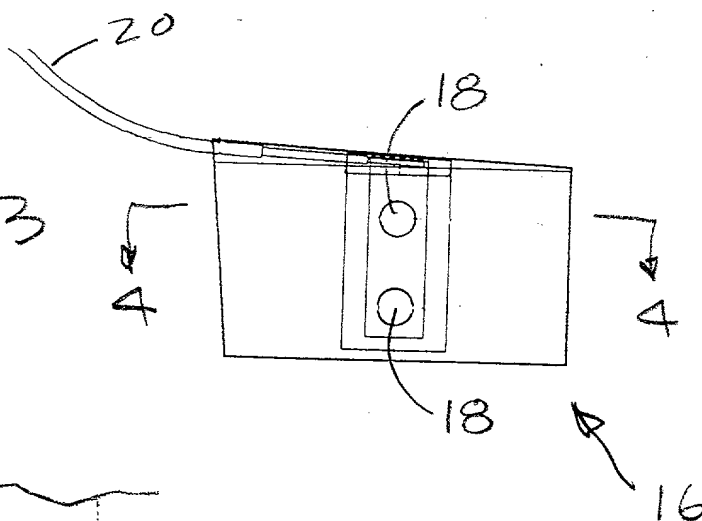
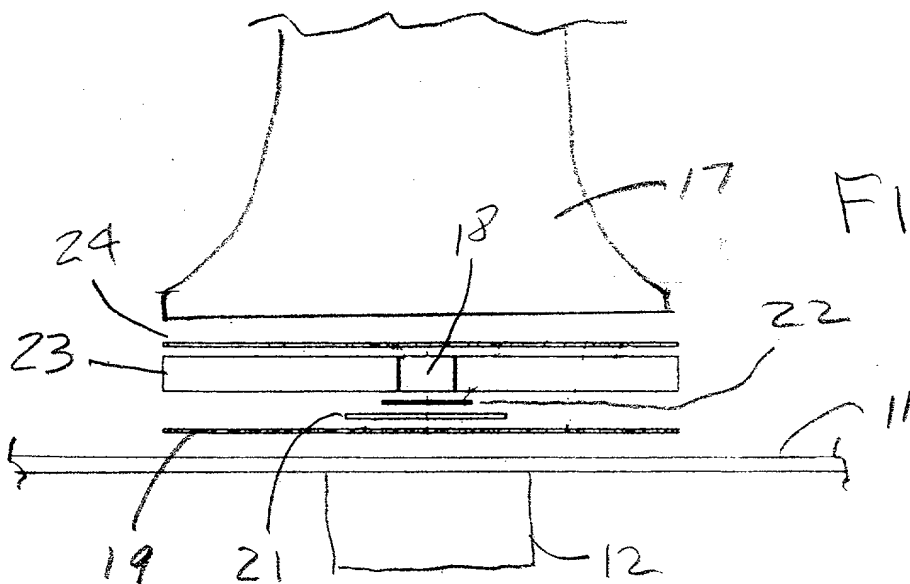


FIG 4



**DECLARATION  
and POWER OF ATTORNEY**

XX ORIGINAL  
\_\_\_ CONTINUATION  
\_\_\_ DIVISIONAL

As a below named inventor, I declare that the information given herein is true, that I believe that I am the original, first and sole inventor if only one name is listed at 1 below, or a joint inventor if plural inventors are named below at 1-4, of the invention entitled:

**ACOUSTIC MUSICAL INSTRUMENT OF THE VIOLIN FAMILY WITH  
PIEZO-ELECTRIC PICKUP**

Which is described and claimed in the attached specification, and for which a patent is sought, and that my residence, post office address and citizenship are as stated below next to my name.

I acknowledge my duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations §1.56(a).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)			
COUNTRY	APPLICATION NUMBER	DATE OF FILING mo. day yr	PRIORITY CLAIMED UNDER 35 USC §119
NONE			YES NO X

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

NONE		
(Application Serial No.)	(Filing Date)	(Status)


**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or Agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Saul Epstein  
14558 Deervale Place,  
Sherman Oaks, CA 91403  
818 789 5346

Reg. No. 25449

1	LAST NAME	FIRST NAME	MIDDLE NAME	Residence: CITY	STATE or COUNTRY
	STEINBERGER	RICHARD	NED	Walpole	ME
	Post Office Address				CITIZENSHIP
	HC 64 Box 090B, Walpole, ME 04573				USA
2	LAST NAME	FIRST NAME	MIDDLE NAME	Residence: CITY	STATE or COUNTRY
	Post Office Address				CITIZENSHIP

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signature of Inventor 1 	Signature of Inventor 2
Date JUNE 23, 1997	Date

Applicant: STEINBERGER, RICHARD NED

Serial No.:

Filed:

For: ACOUSTIC MUSICAL INSTRUMENT OF THE VIOLIN FAMILY WITH  
PIEZO-ELECTRIC PICKUP

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY  
STATUS (37 CFR 1.9(f) AND 1.27(b)) - INDEPENDENT INVENTOR**

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the above entitled invention described in the specification filed herewith.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which could not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

(X) no such person, concern or organization.

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

RICHARD NED STEINBERGER

  
Signature of Inventor

JUNE 23, 1997  
Date